TETA TO-0008
April 15, 1992
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TEST EFFECTIVENESS TREND OBSERVATION

Problem/Failure Cause

CONCLUSION:

On one-of-a-kind JPL pro ects, design related problems are the primary source (about 60%) of the problem/failures occurring during environmental testing of flight hardware. Parts represent 12 percent of the problems on JPL spacecraft, while a comparison with the TIROS/NOAA data base revealed that parts accounted for 28 percent of the problems.

DISCUSSION:

Figures 1 and 2 provide a breakdown by percentage of the problem/failures (PFRs) for three causes, for assembly-level and systems-level environmental tests. For Galileo and later pro ects, protoflight testing was done instead of the previous separate qualification and flight acceptance testing. The cause categories considered are design, parts, and manufacturing & workmanship. The categories cover the usual causes implied in their descriptors.

One observation from the plots of PFR causes is the overwhelming contribution of design to the cause of PFRs at all levels of testing. The percentage of PFRs assigned to the categories of parts and manufacturing & workmanship make a significantly smaller contribution, especially parts, than those associated with design problems.

It should be noted the results are different from those obtained when a similar analysis of data is done for assembly level testing of flight hardware from the TIROS/NOAA spacecraft. This results, of course, from the fact that the TIROS/NOAA satellites are part of a series of block programs with multiple spacecraft, allowing greater chance of design maturity, whereas JPL spacecraft are basically one-of-a-kind.

Figure 3 is a composite of the assembly-level PFR count for the three causes and five pro ects. This figure is provided to allow a comparison with a plot of the TIROS/NOAA results (TDR Data Base) shown in Figure 4. Figure 4 indicates that the most prevalent PFR cause for these pro ects was manufacturing and workmanship. with design second-- only about 32 percent. On the average, the TIROS/NOAA program had half as many design problems as JPL, but twice as many parts problems. This may be attributed to use of a different class of parts or different parts-procurement procedures, or greater design maturity on repetitious spacecraft.

ASSEMBLY-LEVEL P/FS BY CAUSE

VS PROJECT

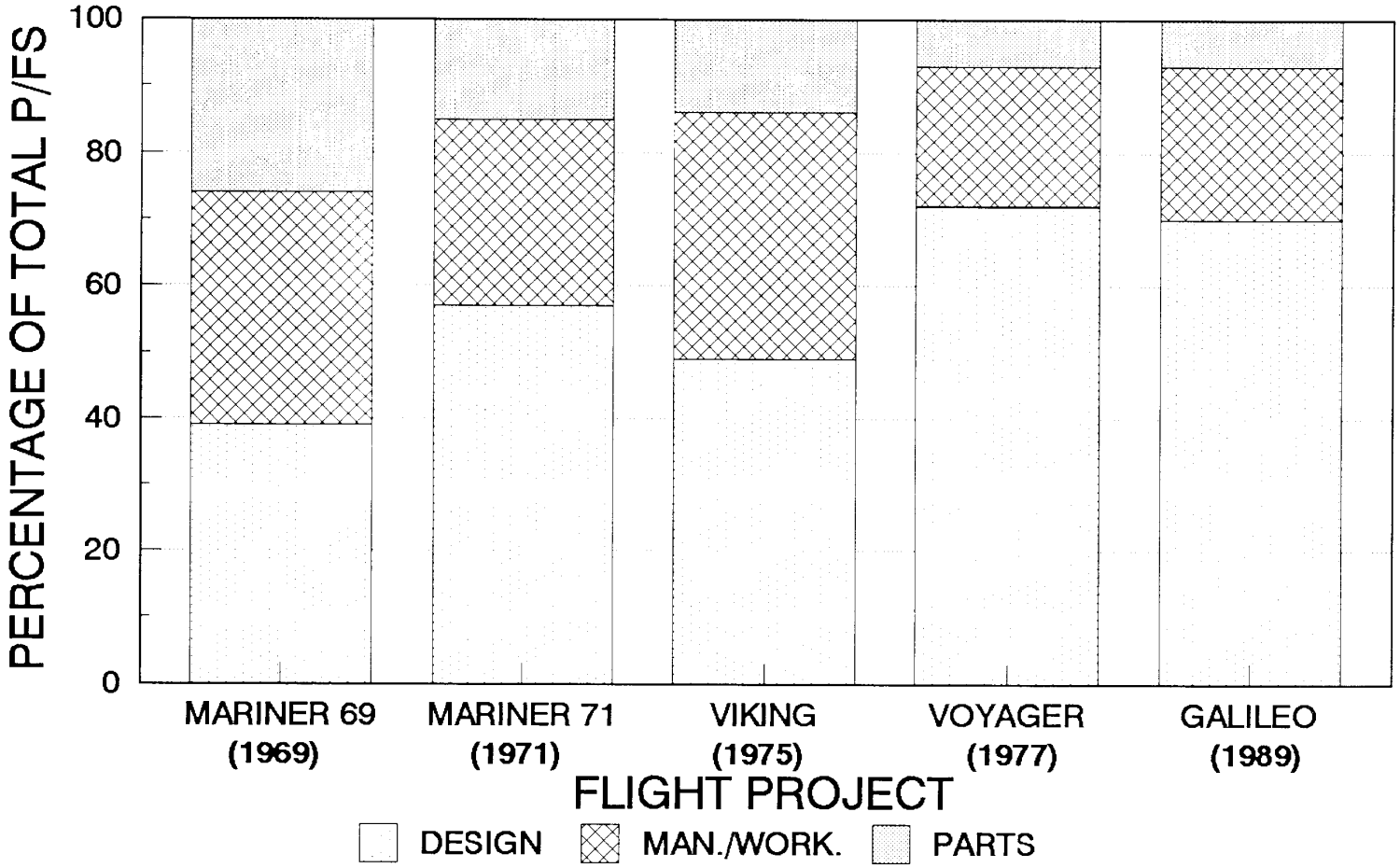
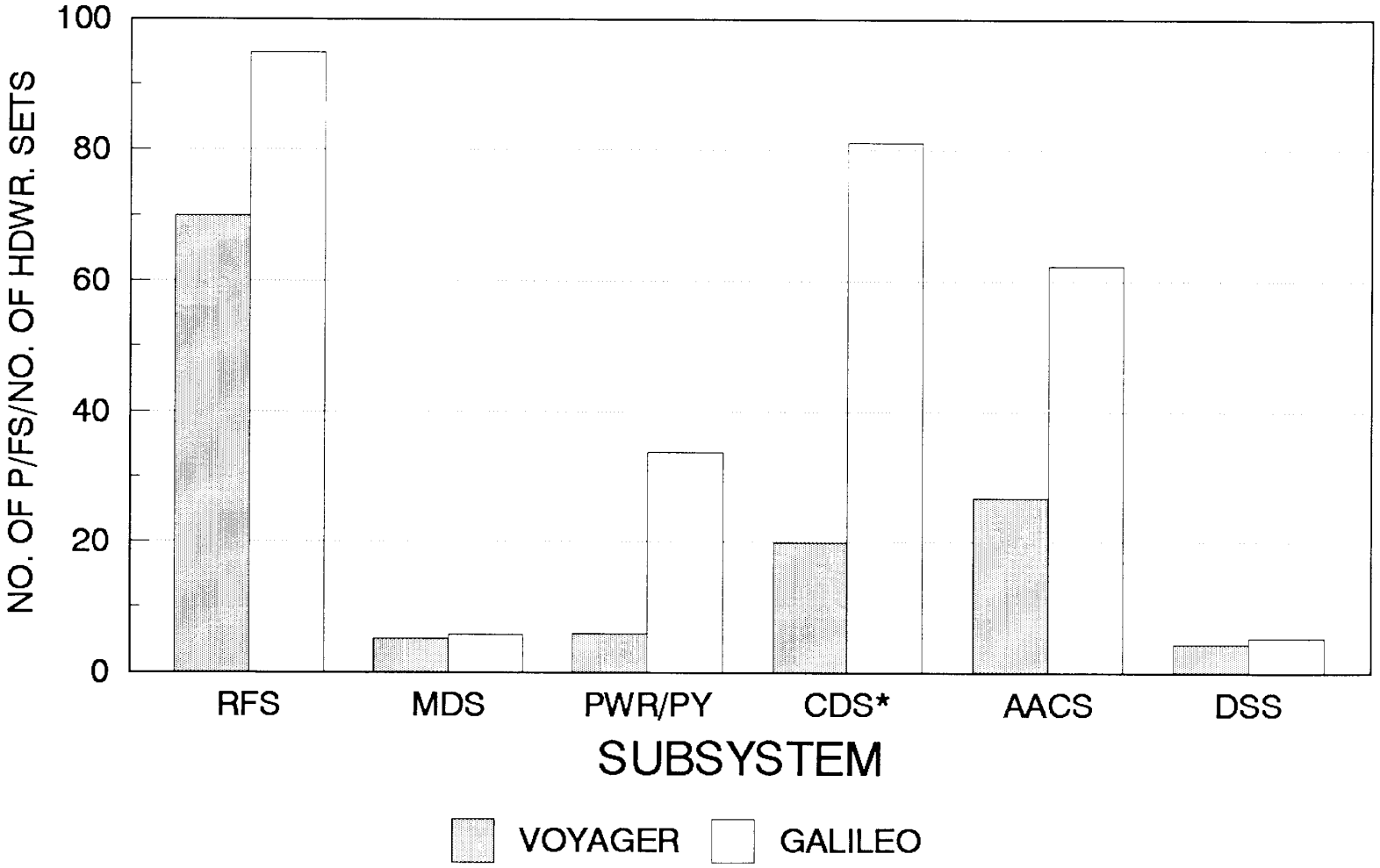


FIGURE 1

VOYAGER & GALILEO P/Fs

ELECTRICAL & ELECTRONIC SUBSYSTEMS



* ON VOYAGER CDS COMPRISED OF CCS & FDS

SYSTEM-LEVEL P/FS BY CAUSE

VS PROJECT

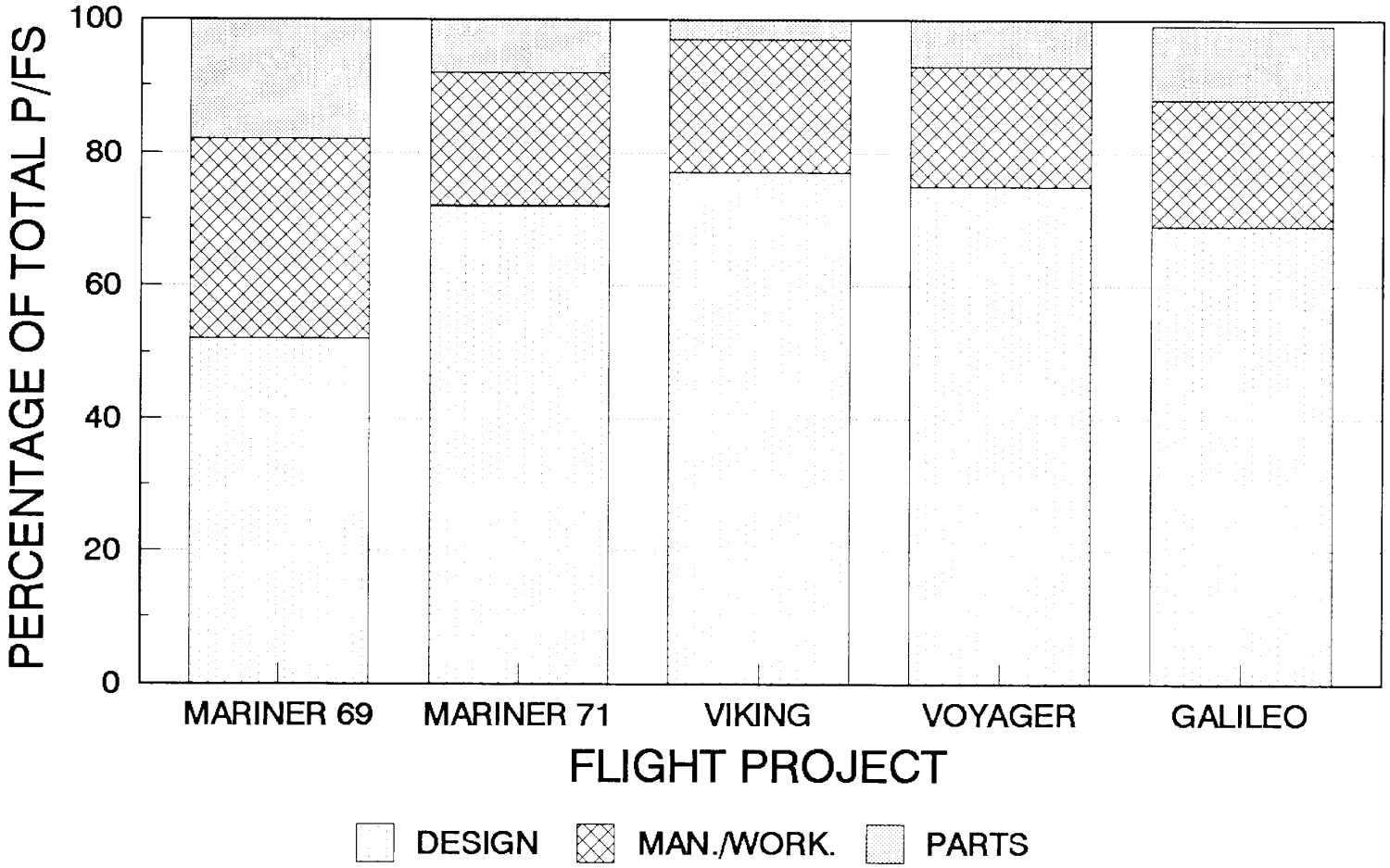


FIGURE 2

P/F CAUSES FOR TDR DATA BASE

BY PERCENT

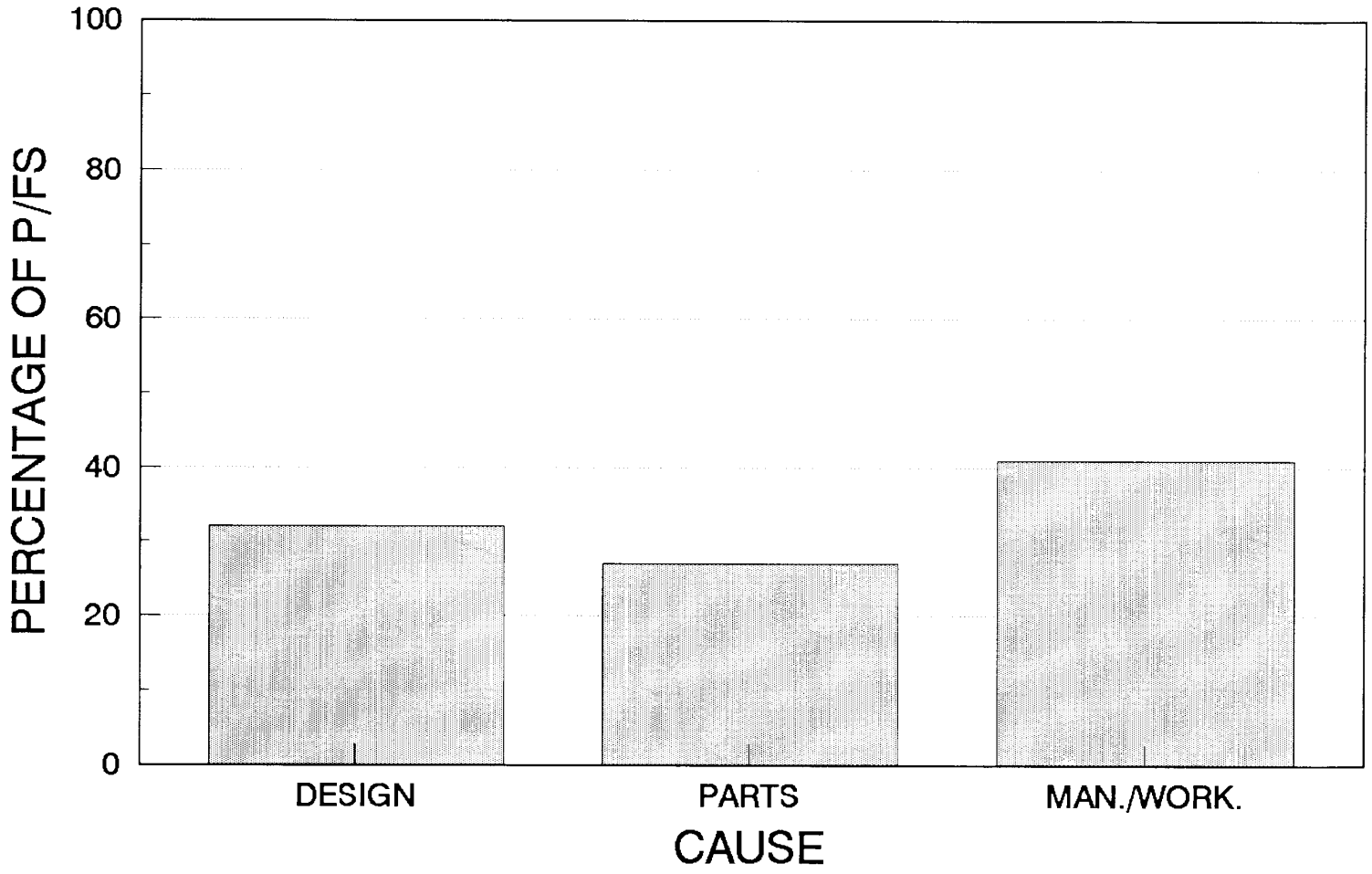


FIGURE 3

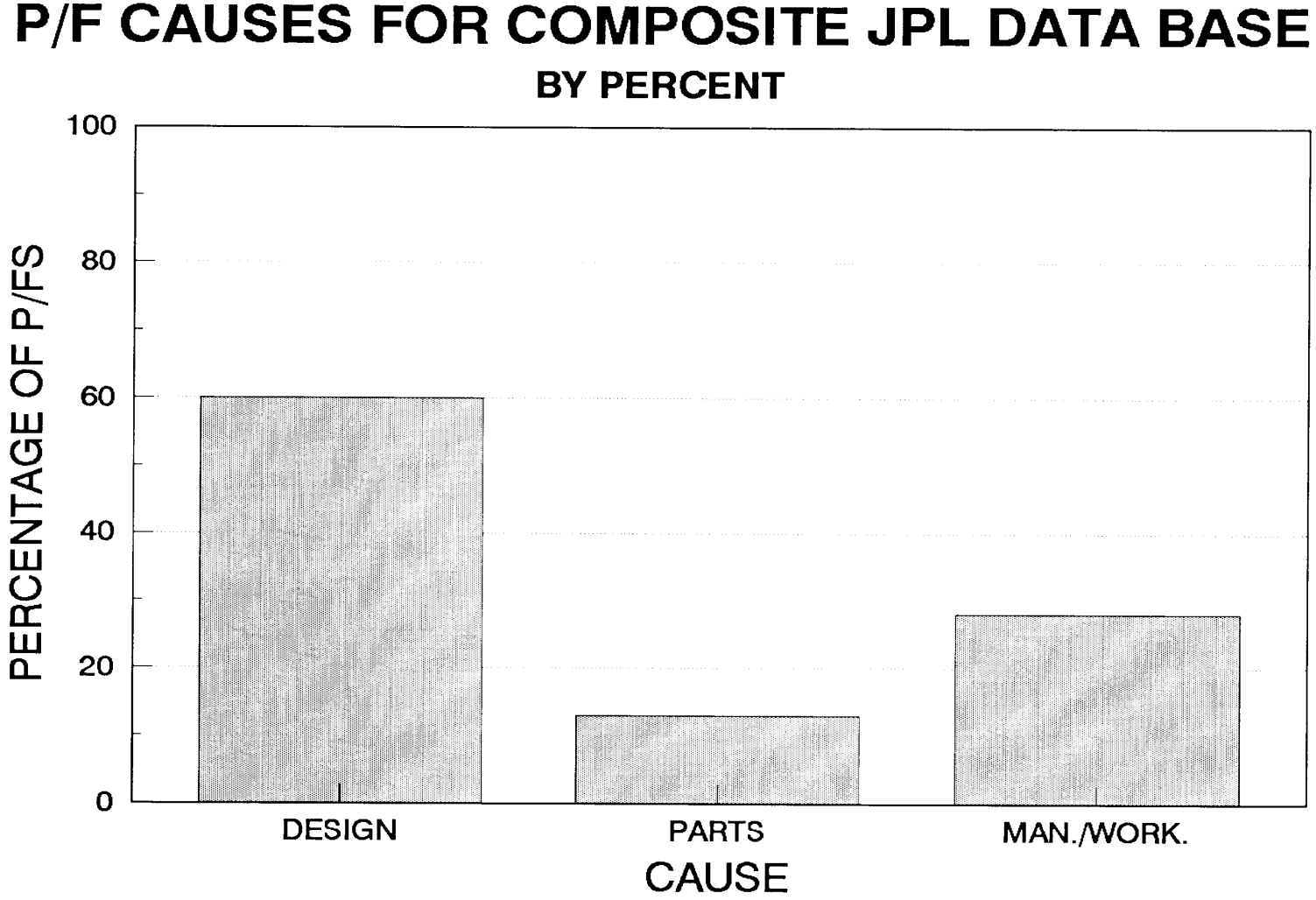

P/F CAUSES FOR COMPOSITE JPL DATA BASE
BY PERCENT
PERCENTAGE OF P/FS
100
80
60
40
20
0
DESIGN
PARTS
MAN./WORK.
CAUSE

FIGURE 4